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RESULTS OF A STUDY TO DETERMINE SOME OVIPOSITION  
HABITS OF THE PANDORA MOTH

by

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In 1963, a 3,800-acre pandora moth outbreak was discovered on the Winema National Forest in southern Oregon during the annual aerial detection survey.<sup>1/</sup> A detection survey and an egg evaluation were planned for the summer of 1964 to determine if control in 1965 should be considered. Prior to the survey, observers noticed many dead moths beneath trees in the infested area. A small study was then begun to determine if the number of moths beneath the crown projection of a tree was directly related to the number of eggs in the tree. Previously, very little was known about the oviposition habits of the pandora moth. This study provided a good opportunity to collect some information along this line that might be helpful in determining future evaluation techniques.

Study Methods

Sample trees were located in an infestation in lodgepole pine on the Chemult Ranger District. A total of 21 codominant and intermediate lodgepole pines was sampled. Each tree was felled and the following data taken:

- (1) Total tree height
- (2) Length of live crown
- (3) D.B.H.
- (4) Number of pandora moth adults beneath the crown projection.

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<sup>1/</sup> Orr, P. W., and Pettinger, L. F. Forest Insect Conditions in the Pacific Northwest During 1963. U.S. Forest Serv., Region 6, 60 pp, March 1964.

All of the foliage and branches were clipped from the tree and packed in polyethylene bags. The bags were transported to a temporary field station at Lakeview and examined for presence of eggs.

Originally 10 trees were sampled. Foliage on these trees was collected and examined separately by live crown thirds. After these data were examined, 11 more trees were sampled and the foliage kept separate by live crown quarters. The purpose of this type of sampling was to see if oviposition sites in the tree resulted from a response by pandora moth females to either light or gravity.

When the trees were sampled, it was noticed that eggs had been laid on two different media--on pine needles and on bare twigs. Therefore, egg masses were kept separate to determine:

- (1) If more egg masses were laid on needles or twigs.
- (2) If more eggs were laid in masses on needles than in masses on twigs.

#### Results

Number of moths beneath each tree and number of eggs per tree varied greatly. Number of moths ranged from 0 to 9 and averaged 3.0. Number of eggs per tree ranged from 12 to 570 and averaged 194.6 (table 1). No significant relationship existed between the number of dead moths beneath a tree and the number of eggs in that tree ( $r=0.32$ ). A definite relationship did occur between total tree height and the number of eggs per tree ( $r=0.46$ ) and also between length of live crown and number of eggs per tree ( $r=0.46$ ) (figures 1 and 2). That is, number of eggs per tree about doubled as tree height or length of live crown doubled.

To see if light or gravity affected selection of an oviposition site, data from trees 1-10 and trees 11-21 were analyzed separately. Results of analyses of data from trees 1-10 showed that no significant difference occurred between number of eggs in the upper crown third and the middle crown third (table 2). Significantly more eggs were found in the upper crown than in the lower crown and in the middle crown than in the lower crown (both at  $p=0.01$ ).

Trees 11-21 were divided into live crown quarters (table 3). Difference between number of eggs in the upper quarter and upper middle quarter was not significant. More eggs did occur in the upper quarter than in the lower middle quarter (at  $p=0.10$ ) and in the upper quarter than in the lower quarter ( $p=0.05$ ). Significantly more eggs were

present in the upper middle quarter than in either the lower middle quarter or the lower quarter (both at  $p=0.05$ ). Also more eggs were found in the lower middle quarter than in the lower quarter ( $p=0.10$ ). Significantly more eggs were deposited in the top half of the trees than in the bottom half ( $p=0.05$ ).

Significantly more eggs were laid on needles than on twigs ( $p=0.01$ ) (tables 2 and 3). However, number of eggs per mass was greater on the twigs than on the needles ( $p=0.01$ ). Number of eggs per mass ranged from 1 to 28 on the needles and averaged 13.7, while on the twigs the number ranged from 2 to 40 and averaged 17.0.

#### Implications

In this study, the number of pandora moth adults beneath a co-dominant or intermediate lodgepole pine did not indicate the number of eggs that are in the tree and, therefore, was not useful as an evaluation device in the outbreak near Chemult. The presence of moths did indicate that some eggs were present in the surrounding trees, so this can apparently be used as a detection device. The relationship between the number of moths beneath dominant trees and the eggs therein is not known. Also the relationship between the number of eggs in codominant and intermediate trees and that in dominant trees is not known.

Significantly more eggs were oviposited in the upper half than in the lower half of codominant and intermediate trees indicating a possible geotropic or phototropic female response. Therefore, during ground surveys, examination of the top crown half of codominant and intermediate lodgepole pines may be helpful in estimating the pandora moth potential for the succeeding year. Oviposition habits of the pandora moth in a pure ponderosa pine stand are not known. However, it would seem that these same responses would hold true.

The relationships established in this study should be tested further before any definite conclusions can be reached.

Table 1.--Summary of data collected during the pandora moth egg studies  
on the Winema National Forest during August 1964

Tree number	Total tree height : live crown:	Length of H.:	D. B. H.:	Moths beneath: tree	Egg masses : per tree	Total eggs per tree	Average eggs per mass
	Feet	Inches				Number	
1	17	14.5	2.7	3	5	83	16.6
2	24	21	3.8	2	41	529	12.9
3	12	9	2.3	1	6	81	13.5
4	30	25	3.5	4	15	236	15.7
5	20	14	3.0	1	7	110	15.7
6	13	11	2.3	3	11	138	12.5
7	6	5	0.8	5	11	185	16.8
8	8	6.5	1.0	9	3	55	18.3
9	9	6.5	1.5	4	8	119	14.9
10	16	11	3.1	5	30	460	15.3
11	13	12.4	2.3	2	11	189	17.2
12	24	23	3.8	7	14	310	22.1
13	14.5	9.8	2.7	1	2	57	28.5
14	20	13	3.5	4	23	355	15.4
15	14.5	10	2.5	0	8	113	14.1
16	15	13	2.1	0	2	12	6.0
17	16	14	2.7	5	44	570	13.0
18	15.5	9.5	2.4	4	8	112	14.0
19	12	10	2.9	0	4	47	11.8
20	19	16	3.5	1	15	256	17.1
21	13	12	2.2	2	4	69	17.3
Average	15.79	12.68	2.60	3.00	12.95	194.57	15.02 <sup>1/</sup>

1/ Weighted average.

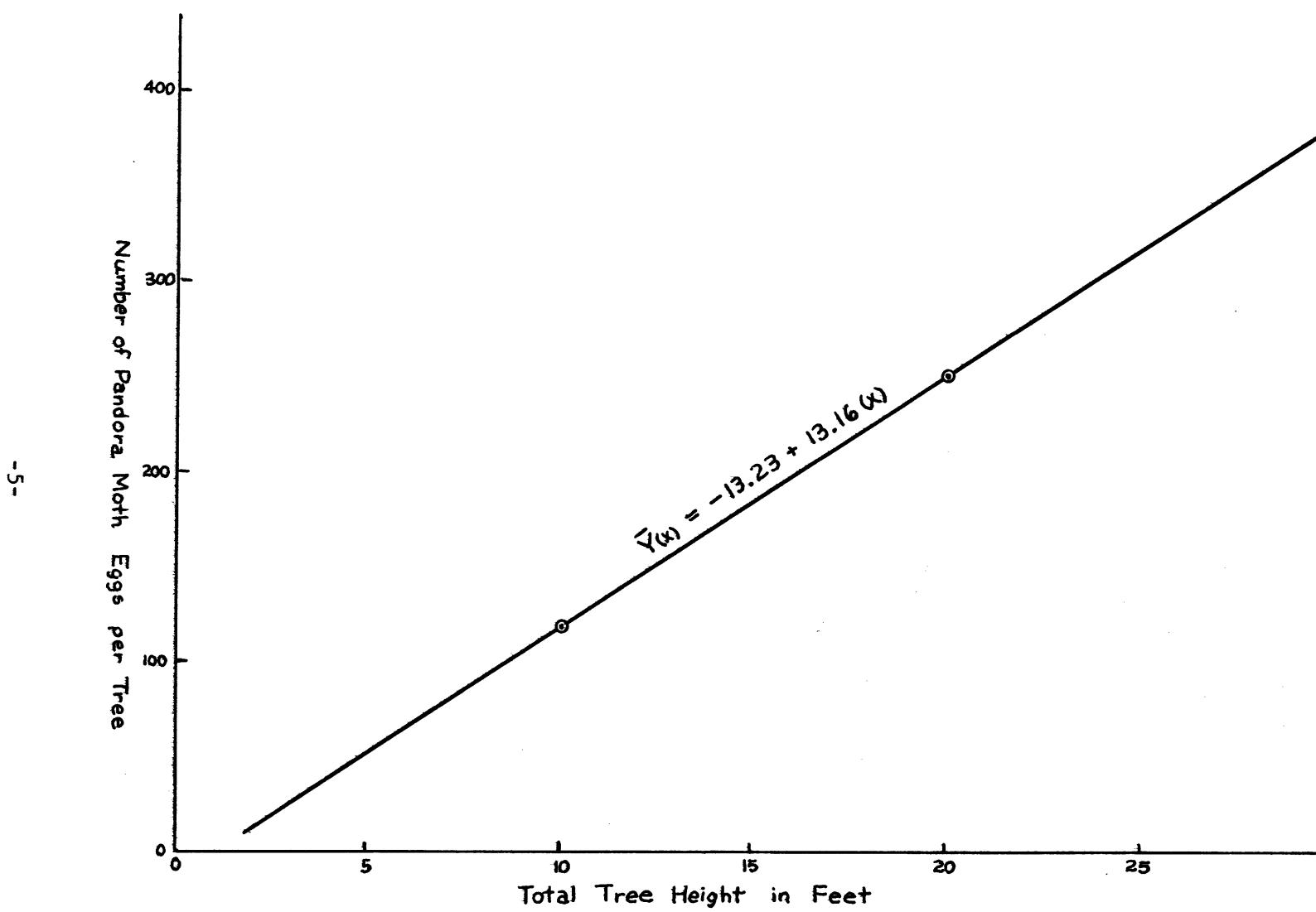


Figure 1.--Relationship between total tree height and number of pandora moth eggs per tree. Winema National Forest. August 1964.

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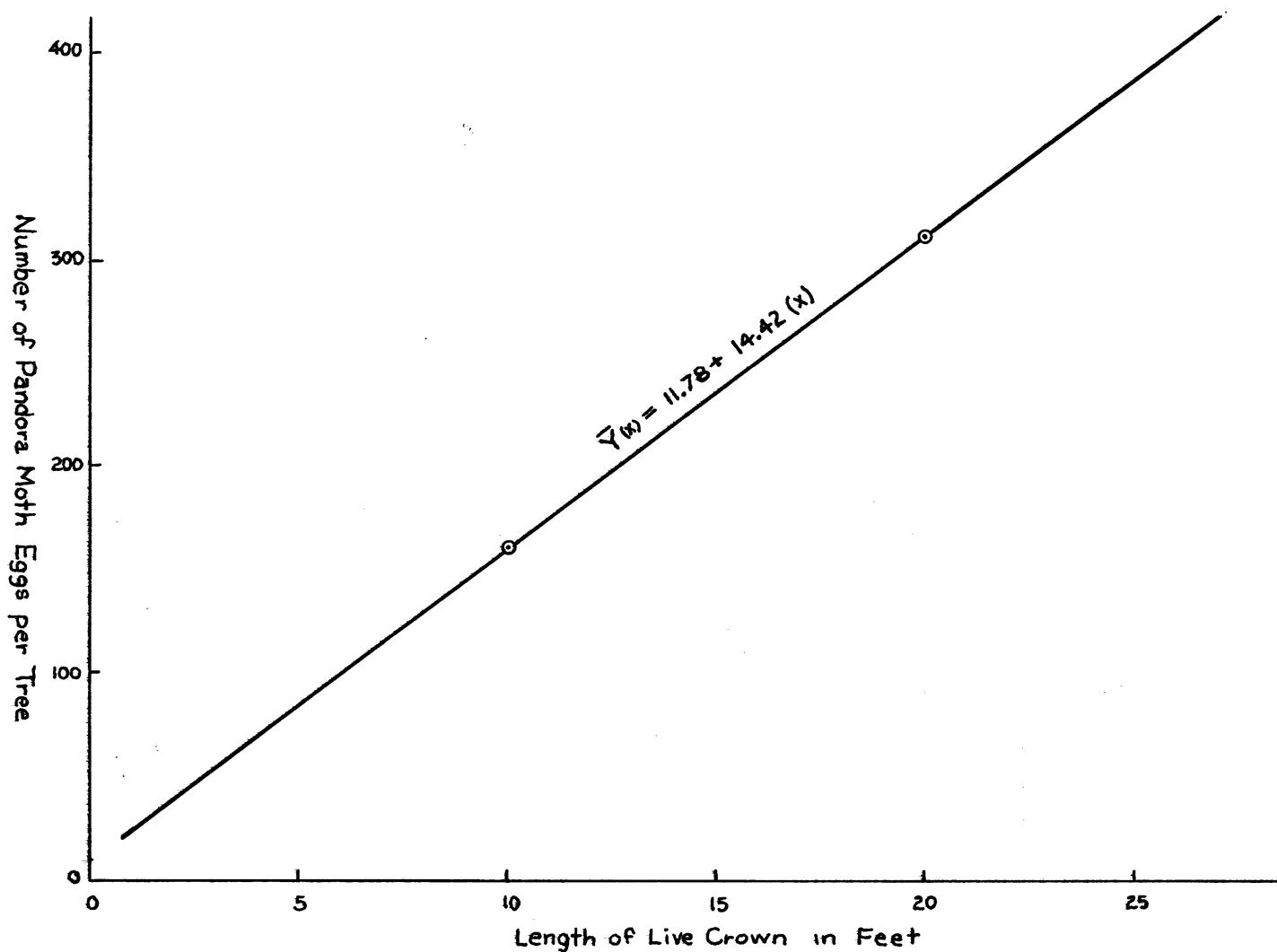


Figure 2.--Relationship between live crown height and number of pandora moth eggs per tree. Winema National Forest. August 1964.

Table 2.--Number of pandora moth eggs collected on sample trees 1-10  
 by crown position and oviposition site; Winema N.F.; August 1964

Tree number	Number of eggs by crown position						
	Upper 1/3		Middle 1/3		Lower 1/3		
	Needles	Twigs	Needles	Twigs	Needles	Twigs	
	:	:	:	:	:	:	
1	0	0	28	55	0	0	
2	154	14	184	44	45	70	
3	32	0	47	0	0	0	
4	153	0	45	22	0	0	
5	42	0	10	37	19	0	
6	114	0	0	20	0	0	
7	75	0	0	89	21	0	
8	39	0	16	0	0	0	
9	58	0	61	0	0	0	
10	69	0	162	110	28	83	
	736	14	553	377	113	153	

Table 3.--Number of pandora moth eggs collected on sample trees 11-21  
by crown position and oviposition site; Winema N.F.; August 1964

		Number of eggs by crown position							
Tree number:	Upper 1/4	Upper-mid 1/4		Lower-mid 1/4		Lower 1/4			
		Needles	Twigs	Needles	Twigs	Needles	Twigs	Needles	Twigs
11	13	0	127	0	27	0	0	18	
12	103	18	64	33	15	17	0	0	
13	42	0	0	0	0	0	0	0	
14	166	0	91	0	19	6	0	53	
15	67	0	11	14	0	13	0	0	
16	2	0	0	10	0	0	0	0	
17	308	0	182	0	38	8	0	8	
18	21	0	59	0	32	0	0	0	
19	24	0	19	0	0	0	0	0	
20	28	0	112	0	33	32	0	25	
21	24	0	0	0	22	0	23	0	
		798	18	665	57	186	76	23	104

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